

CADTH RAPID RESPONSE REPORT:
SUMMARY WITH CRITICAL APPRAISAL

Gastric pH Testing for Neonatal Gastric Feeding Tube Placement: A Review of Clinical Effectiveness, Cost-Effectiveness and Guidelines

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Abbreviations

CRD	Centre for Reviews and Dissemination
NG	Nasogastric
OG	Orogastric

Context and Policy Issues

Enteral feeding is essential for neonates who cannot meet nutritional requirements by mouth, including those receiving intensive care.¹ Enteral feeding involves providing nutrients directly into the stomach using a feeding tube.² For short term use with neonates, orogastric (OG) or nasogastric (NG) tubes are typically used. Accurate placement of OG and NG feeding tubes is important to ensure safe and effective enteral feeding. Feeding through an incorrectly placed tube (e.g., placed in the lungs, pylorus, or duodenum) can cause serious harms or death.^{2,3} The incidence of incorrect tube placement in neonatal patients is not known due to issues with reporting (e.g., lack of standardized or required reporting).⁴ However, based on evidence from individual studies, incorrect feeding tube placement may be common in neonates undergoing enteral feeding. For example, in one retrospective study, 59% (of 381 radiographs) of feeding tubes were placed incorrectly.⁵ Another retrospective study showed 7.1% of radiographs had NG tubes in the esophagus and 5.5% had tube tips placed beyond the pyloric sphincter.¹

Tube placement verification methods are not well standardized and some can be unreliable.^{1,5} The use of pH test strips is one strategy used to verify correct placement of a feeding tube in the stomach. This involves aspiration of gastric fluid by syringe and testing the aspirate for acidity using a pH strip. Various cut-points have been adopted to confirm if the tube is correctly placed in the stomach or if it is unclear where the tube is placed. However, there is uncertainty regarding the appropriateness and feasibility of pH testing in neonates. Regarding appropriateness, newborns have a transient raised gastric pH due to swallowing amniotic fluid as well as a reduced ability to produce gastric hydrochloric acid.⁶ Regarding feasibility, neonates have a very small gastric fluid volume, which can lead to difficulties in obtaining enough aspirate for testing.⁶

The objectives of this report are to summarize the evidence regarding the clinical-effectiveness and cost-effectiveness of gastric pH testing for neonates to confirm NG or OG feeding tube placement. An additional objective is to identify evidence-based guidelines related pH testing to confirm NG or OG feeding tube placement in neonates.

Research Questions

1. What is the clinical effectiveness of gastric pH testing for neonates to confirm nasogastric (NG) and orogastric (OG) feeding tube placement?
2. What is the cost effectiveness of gastric pH testing for neonates to confirm NG and OG feeding tube placement?
3. What are guidelines informing the use of gastric pH testing for neonates to confirm NG and OG feeding tube placement?

Key Findings

No evidence was identified regarding the clinical effectiveness or cost-effectiveness of gastric pH testing for neonates to confirm nasogastric (NG) and orogastric (OG) tube

placement. No evidence-based guidelines were identified regarding the use of gastric pH testing for neonates.

Methods

Literature Search Methods

A limited literature search was conducted on key resources including PubMed, the Cochrane Library, University of York Centre for Reviews and Dissemination (CRD) databases, Canadian and major international health technology agencies, as well as a focused Internet search. Methodological filters were applied to limit retrieval to randomized controlled trials, non-randomized studies, health technology assessments, systematic reviews, meta-analyses, economic studies, and guidelines. Where possible, retrieval was limited to the human population. The search was also limited to English language documents published between Jan 1, 2008 and Sep 12, 2018.

Selection Criteria and Methods

One reviewer screened citations and selected studies. In the first level of screening, titles and abstracts were reviewed and potentially relevant articles were retrieved and assessed for inclusion. The final selection of full-text articles was based on the inclusion criteria presented in Table 1.

Table 1: Selection Criteria

Population	Newborn babies in the neonatal period
Intervention	Gastric pH testing
Comparator	Air method; chest x-ray, gastric secretion aspiration; epigastric region auscultation; checking aspirated secretion's pepsin, trypsin and bilirubin; secretion color; presence of CO ² test; acid test with litmus paper, reading diaphragm's electrical activity; electromagnetic tracing and the use of indigo carmine at 0.01%; no comparator
Outcomes	Clinical effectiveness (both benefits [e.g., effective feeding tube placement] and harms [e.g., bronchopulmonary aspiration, inadequate tube placement, intestinal absorption problems, alimentary intolerance, puncture injuries] with a particular interest in safety data), cost-effectiveness, guidelines
Study Designs	Health technology assessments, systematic reviews, meta-analyses, randomized controlled trials, non-randomized studies, economic evaluations, evidence-based guidelines

CO² = carbon dioxide

Exclusion Criteria

Articles were excluded if they did not meet the selection criteria outlined in Table 1, they were duplicate publications, or were published prior to 2008. Guidelines with unclear methodology were also excluded.

Critical Appraisal of Individual Studies

No relevant literature was identified; therefore critical appraisal was not conducted.

Summary of Evidence

Quantity of Research Available

A total of 708 citations were identified in the literature search. Following screening of titles and abstracts, 698 citations were excluded and 10 potentially relevant reports from the electronic search were retrieved for full-text review. Fifteen potentially relevant publications were retrieved from the grey literature search for full text review. Of these potentially relevant articles, all 25 publications were excluded for various reasons, and none met the inclusion criteria. Appendix 1 presents the PRISMA⁷ flowchart of the study selection.

References of potential interest that did not meet the inclusion criteria are provided in Appendix 2.

Summary of Critical Appraisal

No relevant evidence was identified; therefore critical appraisal was not conducted.

Summary of Findings

No relevant evidence regarding gastric pH testing for neonates to confirm NG and OG feeding tube placement; therefore, no summary can be provided.

Limitations

The use of gastric pH testing for confirmation of NG or OG tube placement in neonates represents a gap in the literature. It is possible earlier studies established the effectiveness and safety of gastric pH testing in neonates, however that is beyond the scope of the current report.

Conclusions and Implications for Decision or Policy Making

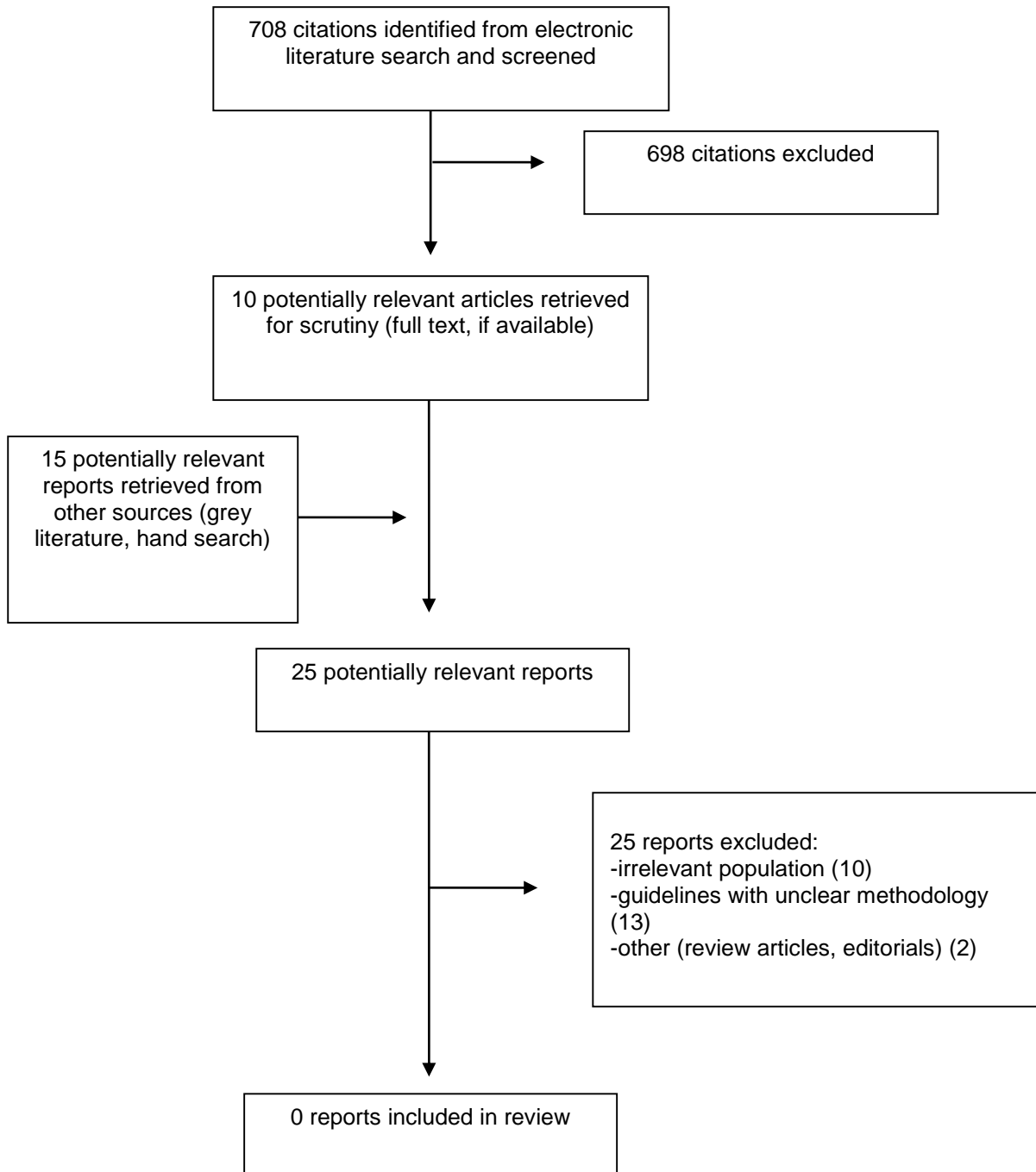
No evidence was identified regarding gastric pH testing to confirm nasogastric NG and OG feeding tube placement specifically in neonates. While neonates were identified as participants in some studies, analyses did not examine neonates separately from older participants. Several clinical practice recommendations of uncertain methodology were targeted toward neonates.⁸⁻¹⁰ These do not appear to have been based on systematic review of the literature, and seem to have adopted the pH criterion value presented by Metheny et al.¹¹ A previous CADTH report examined best practices for optimal method and timing of verification procedures for feeding tube placement, however neonates were not specifically examined.¹² The report showed that a combination of bedside verification methods may be sufficient to confirm absence of tube misplacement, however the evidence was not conclusive.¹² Finally, an integrative review that was not eligible for inclusion and did not conduct critical appraisal of included studies concluded that gastric pH testing was a reliable test for confirming correct or incorrect placement of gastric feeding tubes based on two studies.¹³

Future high quality research addressing the use of pH testing in neonates to confirm NG and OG feeding tube placement is needed to establish clinical effectiveness, age-appropriate cutpoints, safety, and to inform evidence-based guidelines for use with neonates.

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Appendix 1: Selection of Included Studies



Appendix 2: References of Potential Interest

CADTH Reports

Feeding tube verification procedures: optimal timing and guidelines. (*CADTH Rapid response report: summary with critical appraisal*). Ottawa (ON): CADTH; 2011: https://www.cadth.ca/sites/default/files/pdf/htis/feb-2011/L0242_-_Feeding_tube_verification_final.pdf. Accessed 2018 Sep 28.